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tending over more than a year, the following numbers of young have been obtained.

The non-crossover classes have consistently been in excess of the crossover classes. In a total of 83 young, 32 have shown crossover groupings of the two pairs of characters, and 51 have shown non-crossover groupings. This is 38.5 per cent. crossovers, an indicated linkage strength of 23 on a scale of 100.

In a previous paper I have shown that English pattern is allelomorphic with Dutch pattern, or very closely linked with it. If English is linked with dilution, Dutch also must be linked with dilution. Attention should now be turned to the question whether other characters of rabbits belong to this same linkage group, and whether other linkage groups can be detected in rabbits.

W. E. CASTLE

BUSSEY INSTITUTION,  
July 24, 1920

#### THE FAT-SOLUBLE A VITAMINE AND XEROPHTHALMIA<sup>1</sup>

It is generally admitted by those who have conducted feeding experiments with rats that although the essential dietary factors for growth, including the so-called water-soluble B, are present, the animals will not grow to maturity with out the fat-soluble A. The work of Osborne and Mendel, McCollum and associates, Drummond, Steenbock and associates, and others give abundant evidence of this fact. All investigators are not in accord, however, that a positive lack of the fat-soluble A is the direct cause of the eye condition in the rat which McCollum<sup>2</sup> designated as xerophthalmia, some considering this disease to be primarily infectious.

Bulley<sup>3</sup> has recently taken the most definite stand that this eye condition is not due to a dietary deficiency but primarily to infection, resulting from poor hygienic surroundings and uncleanness. She based her conclusions

<sup>1</sup> Read before the American Chemical Society, St. Louis, April, 1920.

<sup>2</sup> McCollum, E. V., and Simmonds, N., *Jour. Biol. Chem.*, 1917, XXXII., 29.

<sup>3</sup> Bulley, E. C., *Biochem. Jour.*, 1919, XIII., 103.

on a study of some 500 rats that were fed on definite synthetic rations.

In our laboratory we have had occasion to feed white, and black and white rats on various synthetic rations and in going over our records we have compiled data bearing upon the prevalence of xerophthalmia in relation to the known presence or absence of the fat-soluble A. These results are given in the table below.

Group	Vitamines Absent from Ration	Number of Rats Reported	Positive Cases, Xerophthalmia	Per Cent. Positive Cases
A . . . .	Fat-soluble A	122	120	98.3
B . . . .	Water " B	103	..	None
C . . . .	None (controls)	216	..	"

It is seen that out of 122 rats, Group A, 120 of them or 98.3 per cent. showed sooner or later positive signs of xerophthalmia, and that when the fat-soluble A vitamine was present, with or without the water-soluble B (Groups B and C), none of the 319 rats showed evidence of this eye ailment. All the rats were fed individually in practically every case. They were kept in metal cages, without any bedding, which were provided with a special removable wire screen floor. The cages, and the food and water cups were always disinfected once or twice a week. The sanitary conditions were, therefore, good. The same assistants handled and fed all the rats so that the attention given them was the same for all and the possibilities of infection from this source was uniform.

It would seem to us that if xerophthalmia was primarily infectious and due to the poor hygienic conditions, that some of the rats in Groups B and C would certainly have developed it. Further, repeated attempts were made to transmit the disease by using sterile threads of gauze, passing them cautiously over the edge of the lids of the sore eyes, and then carefully inoculating the eyes of the other rats. These tests were negative, as were the controls. This was fairly good evidence that the disease could not be transmitted by this means.

Treatment of advanced cases of sore eyes with a saturated boric acid and also with a

silver protein solution failed to relieve the condition. However, when as little as 1 to 2 per cent. of an extract containing the so-called fat-soluble A vitamine was added to the ration, the eyes were speedily cured and the rats increased in weight, indicating that this extract was a specific cure for xerophthalmia.

We therefore agree with McCollum, that xerophthalmia is primarily a dietary deficiency disease, due to a lack of the fat-soluble vitamine. The certainty of the prevalence of the disease depends on the high purity of the essentials that enter into the ration, and on the length of time of feeding, younger animals showing the symptoms much sooner than older ones.

Acknowledgement should be made of the assistance rendered by Miss Marguerite Sturtevant in carrying on this project.

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## THE AMERICAN CHEMICAL SOCIETY

THE fifty-ninth meeting of the American Chemical Society was held at St. Louis, Mo., Monday, April 12, to Friday, April 16, 1920. The council meeting was held on the 12th, a general meeting on the 13th, both in the morning and in the afternoon, divisional meetings all day Wednesday and on Thursday morning, and excursions Thursday afternoon and Friday. Full details of the meeting and program will be found in the May issue of the *Journal of Industrial and Engineering Chemistry*. The registration was slightly over one thousand, eight hundred and twenty-five enjoying the smoker.

General public addresses were given by Paul W. Brown, editor and publisher of "America at Work," on "The Physical Basis for the Economical Development of the Mississippi Valley," by Chas. H. Herty on "Victory and its Responsibilities." The chief public address was given in the assembly room at the Central High School on "Chemical Warfare" by Colonel Amos A. Fries, director of the Chemical Warfare Service.

The following divisions and sections met: Agricultural and Food, Biological, Industrial Chemists and Chemical Engineers, Organic, Pharmaceutical,

Physical and Inorganic, Rubber and Water, Sewage and Sanitation Divisions and the Dye, Leather and Sugar Sections. Further details of their meetings will be found in the May issue of the *Journal of Industrial Chemistry*.

The banquet, held on Thursday evening, April 15th, filled the large banquet hall of the Hotel Statler. Excursions to Laclede Gas Works, Monsanto Chemical Works, East St. Louis plant, and Laclede-Christy Clay Products plant, automobile tour for ladies to parks, Art Museum, Washington University, Missouri Botanical Garden and tea at Bevo Mill and excursion to Standard Oil Refinery, Wood River, Ill., and Illinois Glass Company, Alton, Ill., were enjoyed by all.

A general business meeting was held on Tuesday morning, at which resolutions on the death of Professor Alfred Werner were read by Dr. Chas. H. Herty. Ernest Solvay was unanimously elected an honorary member of the society.

CHARLES L. PARSONS,  
Secretary

### GENERAL PROGRAM

Tuesday, April 13

10 A.M.

*Address of welcome:* HON. HENRY W. KIEL, mayor of St. Louis.

*Response:* DR. W. A. NOYES, president, American Chemical Society.

### General Addresses

*The chemical industry and legislation:* HON. E. P. COSTIGAN, tariff commissioner.

*Victory and its responsibilities:* DR. CHAS. H. HERTY, editor, *Journal Industrial and Engineering Chemistry*.

### General Meeting

*The prediction of solubility:* J. H. HILDEBRAND.

*Selenium oxychloride a neglected inorganic solvent:* VICTOR LENHER. Selenium oxychloride is a liquid whose properties have hitherto been almost wholly neglected. The raw material, selenium, is at present a waste by-product from the electrolytic refining of copper. From the crude material selenium oxychloride can be produced at a very low figure and by the most simple chemical procedure, the actual procedure being to bring in contact selenium dioxide and selenium tetrachloride in carbon tetrachloride solution. Its chemical properties are such that it will probably prove a valuable reagent to the chemist. It is an excellent